

## PATENT COOPERATION TREATY

## PCT



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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY  
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 3.80227/001	<b>FOR FURTHER ACTION</b>		See Form PCT/IPEA/416
International application No. PCT/EP2004/003112	International filing date (day/month/year) 24.03.2004	Priority date (day/month/year) 25.03.2003	
International Patent Classification (IPC) or national classification and IPC C08F210/02, C08F4/642, C08F2/00			
Applicant BOREALIS TECHNOLOGY OY			
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 9 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> sent to the applicant and to the International Bureau) a total of 1 sheets, as follows:</p> <p><input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>			
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the opinion</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input checked="" type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input checked="" type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input checked="" type="checkbox"/> Box No. VIII Certain observations on the international application</p>			
Date of submission of the demand  07.02.2005		Date of completion of this report  06.06.2005	
Name and mailing address of the international preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016		Authorized Officer  Parry, J  Telephone No. +31 70 340-1032 	

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**Box No. I. Basis of the report**

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1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
  - ☐ publication of the international application (under Rule 12.4)
  - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements\*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

**Description, Pages**

1-21 as originally filed

**Claims, Numbers**

1-19 as originally filed  
20-23 filed with telefax on 07.02.2005

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing (*specify*):
  - ☐ any table(s) related to sequence listing (*specify*):
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing (*specify*):
  - ☐ any table(s) related to sequence listing (*specify*):

\* If item 4 applies, some or all of these sheets may be marked "superseded."

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**Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability**

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

- ☐ the entire international application,  
☒ claims Nos. 1-19 and 23 (in part); 20-22 (in full)

because:

- ☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (specify):
- ☐ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):
- ☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.
- ☒ no international search report has been established for the said claims Nos. 1-19 and 23 (in part); 20-22 (in full)
- ☐ the nucleotide and/or amino acid sequence listing does not comply with the standard provided for in Annex C of the Administrative Instructions in that:

the written form ☐ has not been furnished  
☐ does not comply with the standard

the computer readable form ☐ has not been furnished  
☐ does not comply with the standard

- ☐ the tables related to the nucleotide and/or amino acid sequence listing, if in computer readable form only, do not comply with the technical requirements provided for in Annex C-*bis* of the Administrative Instructions.

- ☐ See separate sheet for further details

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**Box No. IV Lack of unity of invention**

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1. ☐ In response to the invitation to restrict or pay additional fees, the applicant has:
- ☐ restricted the claims.
  - ☐ paid additional fees.
  - ☐ paid additional fees under protest.
  - ☐ neither restricted nor paid additional fees.
2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.
3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is
- ☐ complied with.
  - ☒ not complied with for the following reasons:  
**see separate sheet**
4. Consequently, this report has been established in respect of the following parts of the international application:
- ☐ all parts.
  - ☒ the parts relating to claims Nos. 1-19, 23 (in part) .

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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

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1. Statement

Novelty (N)	Yes: Claims	14 17 (in part)
	No: Claims	1-13,15,16,18,19, 23 (in part)
Inventive step (IS)	Yes: Claims	
	No: Claims	1-19 ,23 (in part)
Industrial applicability (IA)	Yes: Claims	1-19,23 (in part)
	No: Claims	

2. Citations and explanations (Rule 70.7):

**see separate sheet**

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**Box No. VIII Certain observations on the international application**

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The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

**see separate sheet**

**Re Item I**

**Basis of the opinion**

The amendments are allowable.

**Re Item III**

**Non-establishment of opinion with regard to novelty, inventive step and industrial applicability**

According to the ISA, only the following subject matter has been searched:

1. the subject matter of claims 1-19, 23 (in part) insofar as it relates to formula I where  $n = 0$ .

All other subject matter of the present application has not been searched and therefore only the above mentioned subject matter under point 1 can be the subject of examination (Rule 66.1(e), Art. 17 (3) PCT (see Box IV (unity of invention))).

**Re Item IV**

**Lack of unity of invention**

1. The present application is found to contravene the requirements of unity of invention according to Art. 3(4)(iii) PCT, Art. 17(3)(a) PCT and Rule 13 PCT for the following reasons:

the general concept underlying the claims of the present application is the synthesis and use in olefin polymerisation processes of metallocenes according to claim 20, formula III possessing at least one alkyl substituent at the cyclopentadienyl ring and comprising an alkyl group at the metal with no beta hydrogen atoms (feature 1). This is the element common to all claims, not the nature of the cocatalyst. Thus, it is the anticipation of feature 1 of the common concept by the prior art and not the anticipation of claim 1 which is of relevance in assessing lack of unity, and this concept is well known (see D3: WO9736937, claims 7 and 18). D3 discloses Cp or Cp-based complexes including those with indenyl ligation such as  $\text{Cp}_2\text{ZrBz}_2$ ,  $\text{Cp}^*\text{ZrBz}_2$ ,  $(\text{Cp}^n\text{Bu})_2\text{HfBz}_2$  and " $\text{Cp}_2\text{Zr}(\text{CH}_2\text{SiMe}_3)$ ". In the latter case the presence of one methyltrimethylsilyl group implies a zirconium (III) centre (see claim 7). Polymerisation of propene and ethylene-octene is disclosed in the examples

using borato-benzene cocatalysts. Hence the anticipating character of the disclosure of D3 resides in non-bridged metallocenes, ie where  $n$  of claim 1 is equal to zero.

According to the present application, the problem arising from the synthesis and use of olefin oligomerisation/polymerisation catalysts comprising these supported catalysts can be solved in various ways 1-3, as grouped below. Thus groups 2 and 3 additionally exhibit technical features which are special over D1.

Group 1: the subject matter of claims 1-19 and 23 (in part) insofar as it relates to formula I where  $n=0$ .

Group 2: the subject matter of claims 1-19 and 23 (in part) insofar as it relates to formula I where  $n=1$ .

Group 3: the subject matter of claims 20 -22 (in part), excluding the subject matter of groups 1 and 2.

All these groups above are linked by the common concept as defined above, however, in the light of D3 this feature is not special and there is therefore no single general inventive concept (Rule 13.1 PCT).

Each of the special technical features represented by 2-3 above is different and since they do not lead to the same effect (that is, it has not been demonstrated in the present application that they lead to the same effect), these special technical features are not corresponding either. Hence, no same or corresponding special technical features can be identified amongst the different inventions 1-3 that can link them (Rule 13.2, PCT). Thus, the requirements of Rule 13.1 and 13.2 PCT are not met, and the application lacks unity of invention.

2. Note, in any case that any reconsideration of the finding of lack of unity would have not result in any reconsideration of the subject matter to examined under Box III, since Box III is a consequence of the procedure followed at the search phase which is now closed. Thus, there may be many anticipations of bridged species falling under present claim 1 where  $n=1$  serving as slurry-phase catalysts when employed in conjunction with alumoxane, but the prior art pertaining to such disclosures has not been searched and therefore cannot be examined here (see Box III).

**Re Item V**

**Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

I. The following documents (D4 and D9) will be referred to in this communication:

- D4: WO 00/40620 A (LEHTINEN ARJA ;SALO EIJA (FI); HOKKANEN HARRI (FI);  
KALLIO KALLE () 13 July 2000 (2000-07-13)  
D9: WO 02/059160 A (UNIVATION TECH LLC) 1 August 2002 (2002-08-01)

II. With regard to the present examples, the present application relates to complexes of the type  $\text{Cp}_2\text{HfBz}_2$ ,  $\text{Cp}_2\text{Hf}(\text{CH}_2\text{TMS})_2$  ( $\text{Cp} = \text{Cp}$ ,  $\text{CpnBu}$ ) which are used for ethylene-hexene copolymerisation in conjunction with MAO on silica supports. These alkyls, which lack beta hydrogen atoms, show higher activity than the corresponding chlorides according to the present comparative examples.

III. 1. (i) D9 discloses in example 9 the compound  $(\text{CpMe})_2\text{ZrBz}_2$ , used with a borate cocatalyst on a polystyrene support in the gas phase polymerisation of ethylene (see p. 33, eg 9). MAO is also added as scavenger to the reactor in the examples (see p.28, I.7). Slurry phase polymerisation is conducted for the dihalide analogues (see p.36-37, examples 15-17). The skilled person would thus seriously contemplate slurry phase processes (see claim 7) employing compounds such as  $(\text{CpMe})_2\text{ZrBz}_2$ . Hence claims 1-10, 18, 19 and 23 are not novel. Since these claims are not novel, no analysis of inventivity is required.

(ii) It is trivial to vary the ratio of polymer produced in the various polymerisation reactors, different types of which are already disclosed in D9 and D4. D4 discloses ethylene polymerisation processes using  $(\text{CpnBu})_2\text{HfCl}_2$  which is supported on silica/mao, but in claim 1, an ethylene polymerisation process employing  $\text{CpR}_2\text{ZrBz}_2$ , which can only be selected from two lists is disclosed, and claim 5 discloses a silica support and claim 7 discloses alumoxanes as cocatalysts. P. 23 and table 4 and claims 10 and 11 mention loop (slurry) and (multiple cascade) gas phase reactors used together. Hence claims 11-16 are not inventive.



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(iii) Prepolymerisation is standard in the art, hence claim 17 is not inventive

**Re Item VIII**

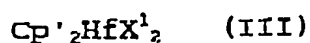
**Certain observations on the international application**

I. The following objections are made under Art. 6 (PCT):

1. Claim 1: (i) It is confusing to define a bridging group only later to define it as absent.

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20. Metallocene compounds of formula (III)



5 wherein each Cp' denotes a mono or di C<sub>1-6</sub>-alkyl-substituted cyclopentadienyl, X<sup>1</sup> is benzyl or CH<sub>2</sub>SiR', in which R' is C<sub>1-20</sub>-hydrocarbyl.

10 21. A metallocene compound as claimed in claim 20 wherein R' is methyl.

22. The metallocene compounds:

15 bis(n-butylcyclopentadienyl)Hf dibenzyl,  
bis(methylcyclopentadienyl)Hf dibenzyl,  
bis(1,2-dimethylcyclopentadienyl)Hf dibenzyl,  
bis(n-butylindenyl) Hf dibenzyl,  
bis(methylindenyl) Hf dibenzyl,  
bis(dimethylindenyl) Hf dibenzyl,  
20 bis(n-propylcyclopentadienyl)Hf dibenzyl,  
bis(i-propylcyclopentadienyl)Hf dibenzyl,  
bis(n-butylcyclopentadienyl) Hf (CH<sub>2</sub>SiMe<sub>3</sub>)<sub>2</sub>,  
bis(n-propylcyclopentadienyl) Hf (CH<sub>2</sub>SiMe<sub>3</sub>)<sub>2</sub>,  
bis(i-propylcyclopentadienyl) Hf (CH<sub>2</sub>SiMe<sub>3</sub>)<sub>2</sub>.

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23. An olefin produced by a process as claimed in any one of claims 1 to 19.